

Physiology of muscle contraction:-

- It had been thought the muscle contraction must be a folding process

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Researchers discovered that skeletal muscle shortens during contraction bcz thick & thin filaments slide over one another.

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The model describing this process is known as sliding filament mechanism.

Sliding Filament Mechanism:-

- Muscle contraction occurs bcz myosin heads attach to myosin binding site at actin and walk along the thin filament at both ends of sarcomere

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pulling thin filaments towards the M line

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As thin filaments slide inward the Z-discs come closer sarcomere shortens

(length of individual thin & thick filaments does not change)

- shortening of sarcomeres caused shortening of whole muscle fiber.
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So, shortening of Entire Muscle.

The contraction cycle:-

At start of contraction $\rightarrow$ SR releases (Ca^{2+}) in cytosol

$\downarrow$
 Ca^{2+} bind to Troponin

$\downarrow$
Troponin then move Troponin away from Myosin binding site on Actin.

$\downarrow$
Once the binding sites are free

$\downarrow$
contraction cycle begins
(occurs in 4 steps)

1) ATP hydrolysis:-

- The Myosin head contain - ATP binding site and ATPase.
Enzyme that hydrolyzes ATP to ADP + P_i

$\downarrow$
This hydrolysis reaction reorients and energizes myosin head
[Product of hydrolysis of ATP $\rightarrow$ ADP and phosphate group are still attached to myosin head].

2) Attachment of Myosin to Actin to form cross bridges:-

- The energized myosin head attaches to the myosin binding site on actin releases phosphate group.

- When myosin head attach to actin during contraction

$\downarrow$

They are referred as cross bridges.

3) power stroke:- After cross bridges form power stroke occurs.

- During power stroke, the cross bridge rotates and release ADP.

$\downarrow$
crossbridge generates force as it rotates towards centre of sarcomere.

$\downarrow$
Sliding thin filament on thick filament towards the M line

(4) Detachment of myosin from Actin:-

- At the end of the power stroke



crossbridge remains attached to Actin until it binds.

Another molecule of ATP.

- As ATP binds to ATP binding site on Myosin head.



Myosin head detaches from Actin.

[The contraction cycle repeats as Myosin ATPase hydrolyzes newly bound molecule of ATP



continues as long as ATP is available and Ca^{2+} level near

the thin filament is sufficiently high.

- Each of 600 crossbridges in one thick filament attaches and detaches about five times per second.